Rodent Control in Food Establishments*

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IT is a pleasure and an honor for me to be here to participate in the discussion of a problem of major importance to both the American Public Health Association and the Biological Survey, the health workers being interested in safeguarding the health of this nation, and of the world, from rat-borne diseases, and the survey in controlling an animal that is a greater menace to the health of mankind and a greater destroyer of property than any other in the world.

My subject, "Rodent Control in Food Establishments," means rat control in food establishments, because the rat constitutes the major rodent problem in such places and, with the exception of the house mouse, is the only one with which we need be concerned. The brown rat (*Rattus norvegicus*) is the common rat known throughout this country. Another species of the same genus, the black rat (*Rattus rattus*), is present in parts of the southern and southeastern states.

I am well aware that members of the American Public Health Association are much more familiar than I am with the diseases of human beings that rats transmit and the manner in which each of those diseases is harbored or incubated; therefore I shall make only passing reference to some of the more important of the rat-borne diseases.

Bubonic plague, after its first occurrence in San Francisco in 1900, was contracted by ground squirrels of adjacent areas and has become endemic in our native fauna to such an extent that it has not been possible to eradicate it. This form in the wild rodents is known as sylvatic plague and has been identified in several thousand rodents, including ground squirrels, mountain rats, deer mice, and woodchucks, in California, Oregon, Utah, Idaho, and Montana. The sylvatic form of plague is apparently not highly contagious to man, but there is the disturbing possibility that common rats may become reinfected in the population centers and the plague may then return to the more serious form.

Endemic typhus, or Brill's disease, is assuming serious proportions in the United States. There was a rapid increase from 1931 through 1933, at which time it was approaching epidemic proportions. Early in 1934 anti-rat campaigns to control typhus fever were undertaken by the Biological Survey as a Civil Works Administration project in coöperation with the U. S. Public Health Service and state health departments. Poisoned baits were exposed and trapping operations conducted on more

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than three-quarters of a million premises. The disease was successfully checked, but not eradicated.

Spirochetal jaundice is a dangerous rat disease transmissible to man. A high percentage of rats have been found infected where outbreaks have occurred.

Rat-bite fever is transmitted to man by the bite of the rat. Relatively few cases have been reported in the United States, but many rats carry the organism in the saliva, and infection is always possible following the bite of a rat.

Food poisoning caused by infection with *Salmonella* organisms may be caused by rats. These organisms are of animal origin and are frequently found in rats which transmit them to human food by their droppings.

Rats play a part in the spread of other diseases, such as tularemia, rabies, and trichinosis, and no doubt are more of a factor than is generally recognized in spreading various parasites and diseases that affect man.

Food establishments frequently are centers of rat infestation in urban communities, sometimes being almost wholly responsible for a heavy rat population radiating for several city blocks.

With such concentrations of rats the probability of the spread of disease is increased, and where the rats are in proximity to, and often in direct contact with, stores of human food, and where the parasites of rats may be transferred readily to human beings, the probability of disease being transmitted to human beings is correspondingly increased. An example of this is found in the records of the State Health Department of Alabama, which show that in one city typhus fever was contracted by 8 employees of one grocery, 7 of another, 5 of another, and by 3 employees of a grain handling company. In another city in the same state 4 recent cases of typhus were traced to one general merchandise establishment. In all these places there was heavy rat infestation.

In undertaking to control rats in any food establishment, such as a restaurant, grocery, or warehouse, the condition of the entire neighborhood should be taken into consideration. If the establishment is surrounded by well kept premises harboring few or no rats, control measures may be necessary only at the establishment. On the contrary, if the neighborhood contains other rat-infested and rat-harboring premises, any effort to control rats in the food establishment alone is likely to have uncertain results unless the building is made impervious to rats from the basement to the roof, and even then constant vigilance will be necessary. Community work is called for under such circumstances.

It is generally accepted that the only permanent solution of the rat problem in this country is ratproofing, combined with sanitation, and the elimination of rat harbors. Rats will thrive as long as they have food and shelter and safe access from one to the other. Remove the food or the shelter, or place a barrier between the two, and rats cannot survive. The practical application of this principle is sometimes simple and easy and sometimes rather difficult, but usually the manager of a food establishment with a rat problem will find it economically profitable to ratproof the premises and dispose of waste food in ratproof containers. In some places these things are compelled by law because of the health factor, but in many places they are not.

Ratproofing buildings, even those housing food establishments, cannot be expected throughout this country in a short time. When new buildings are constructed and older ones are rebuilt or repaired, however, ratproofing should be included in the plans. Many recent buildings and some in process of con-

struction today lack proper ratproofing devices, which could have been installed during construction with little or no added cost.

If adequate ratproofing features were included in the construction of all new buildings, the rat problem in this country would be solved in a comparatively short time. Information on how to ratproof buildings and premises is available in bulletins of the U. S. Department of Agriculture and of other organizations.

Poisoning offers a quick means of reducing rat populations, and, properly considered as a temporary measure in conjunction with ratproofing as an eventual permanent measure, it fills an important place in rat control.

If the rat problem is confined to one establishment, poisoning operations may be undertaken by the owner of the particular property involved, but if it involves other premises in the neighborhood or is city-wide, it must be handled through a neighborhood or city-wide campaign to obtain satisfactory results.

Since the development of red squill as a raticide, a poison that will kill the rats but is relatively harmless to human beings and domestic animals is available. Rats usually will eat squill baits that are properly prepared and exposed, whereas dogs, cats, poultry, and pigs either refuse to eat these baits or promptly vomit them. Valuable animals should not be allowed access to squill baits, although the chances of serious injury to them are comparatively slight. Nausea and vomiting appear to be the most serious effects of red squill on human beings.

Red squill raticides are made from the bulb of the plant *Urginea maritima*, a perennial belonging to the lily family. There are two commercial varieties of squill, apparently not distinguishable botanically. White squill is used in human medicine, and red squill is used in raticide preparations. The red squill rat poison available on the market is made from the dried and ground bulb and sold as powdered red squill, or under various trade names. The use of liquid extracts of red squill in raticides is being studied.

Powdered red squill cannot be recommended at present as a rat poison without certain reservations, because the product may vary from a satisfactorily high toxicity to practically none at all. In order to obtain a powder of maximum toxicity it is necessary to dry the red squill bulbs under controlled temperature conditions. Some of the squill powder sold for killing rats has been manufactured properly and is dependable; other powder has not, and its toxicity is extremely uncertain. The Biological Survey is working toward a remedy for this situation.

An effort is being made to establish a standard for powdered red squill with a minimum lethal dosage of not more than 400 mg. per kg. of rat. Such a product, when mixed with food in the proportion of 1 part squill powder to 16 parts food by weight makes a bait strong enough for practical purposes. If the squill were a little weaker it would have to be mixed with the food in correspondingly greater proportion, but if the proportion is much greater the acceptance of the bait by the rats is reduced.

In using powdered red squill to destroy rats, the choice of bait is most important. The aim is to destroy every rat with one application; otherwise, the survivors become suspicious and are hard to dispose of later. This requires an ample supply of bait that appeals to the appetites of the rats. In establishments where a variety of foods may be constantly available to the rats, an effort should first be made to get all foods out of their reach a few days before attempting to poison. A further help is to prebait with small quantities

of unpoisoned foods of the kinds proposed to be used as bait. If this prebait is well taken, the poisoning may follow immediately, but if it is not taken, there is little use in putting out poison in the same kind of food. Careful attention to details of this kind can be given by an individual in treating his own premises. In extensive campaigns involving the treatment of all premises over considerable areas, it may be impracticable to prebait because of the added time and expense. Property holders in the area,however, are asked to keep all garbage and food materials out of reach of rats for a few days before the campaign.

The baits most commonly used in the rat poisoning campaigns of the Biological Survey are prepared according to the following formulae, also recommended for general use, though a variety of other foods are sometimes advisable:

a. Meat bait—
1 lb. powdered red squill, high toxicity
15 lb. ground fresh beef, uncooked
1 lb. corn meal

Mix corn meal and squill dry; then mix into meat, adding a very little water if necessary. Squill must be thoroughly mixed through the meat.

b. Cereal bait—
1 lb. powdered red squill, high toxicity
11 lb. rolled oats of good quality
4 lb. corn meal finely ground

Mix ingredients dry and then stir in enough water to make a rather moist dough.

In the eastern states canned red squill rat bait prepared under Biological Survey supervision is being used.

The two baits described above are kept separate and are exposed in teaspoonful lumps where the rats will find them, alternating a lump of meat and a lump of cereal. It is very necessary that enough bait be put out at the first baiting to supply all rats that may visit the premises. Every rat requires a good big teaspoonful of bait, and a dozen spoonfuls put out among 100 rats will show little results. If there are 100 rats, there should be 150 spoonfuls of bait.

Poisoning operations, whether on one property or city-wide, generally should not be undertaken oftener than two or three times a year. Constant baiting with red squill, or most other poisons, particularly if done in a haphazard manner, will often result in educating the rats to avoid poison. If additional control measures are necessary, trapping may be resorted to, or some poison other than red squill may be tried if it can be used safely.

Rat traps will prove effective if the trapper will give a little attention to details. Traps must be kept clean. They should be baited every day with fresh baits such as bread, fresh meat, pecans, bacon, and pumpkin, and location changed every few days. Plenty of traps must be used as it is just as impossible to clear out 100 rats with one or two traps as it is with an insufficient amount of poisoned bait. Cheese is not always the best bait to use.

I have said nothing as yet about the control of house mice. Ratproofing helps to keep out mice but is less dependable than in rat control. Trapping is the best remedy as a general rule, and the same attention recommended for trapping rats will pay dividends in trapping mice.

If poisoning is necessary for the control of mice, a bait can be made as follows:

Mix 1 oz. of powdered strychnine alkaloid with 2 oz. of common borax, and stir dry into 8 lb. of rolled oats. The large-flaked oats are better than the 3 minute type.

The poisoned flakes may be exposed in teaspoonful quantities in places where mice frequent or may be left in little boxes or stations where it will provide a permanent poison supply available to mice at all times. This bait must, of course, be handled with care.

Rats and mice have shared man's food for many centuries, taking what they want and spoiling much more than they eat. The rat has killed man by the millions through transmitting disease germs, and is today the most dangerous and most destructive animal in the world. What we may work for and hope for is a rat-conscious public that will not tolerate rats.

Tentative Method for the Assay of Vitamin D Milk

THE Association of Official Agricultural Chemists, Washington, D. C., has adopted the following tentative method for the assay of vitamin D milk:

The basic method for the assay of vitamin D milk shall be the Method of Assay for Vitamin D in Cod Liver Oil described in the Pharmacopoeia of the United States XI, page 478.

Collection and Preservation of the Sample:

Unless the sample of milk, in the original bottle, can be delivered to the assayer immediately after collection it shall be stored under refrigeration until delivered. Shipment to the assayer shall be made in an iced container. After acceptance by the assayer the milk can be preserved in its original homogeneous state by (a) suitable refrigeration for a period of not more than 1 week, or (b) for a period of not more than 1 month by the addition of 2 drops of 10 per cent formalin and suitable refrigeration.

Administration of Supplements and Duration of the Assay Period:

The calculated quantities of U.S.P. Reference Oil and of the sample of milk may be fed and the assay period varied according to the following options. The U.S.P. Reference Oil and the milk sample must be fed according to the same plan.

1. According to the U.S.P. XI method.
2. The supplements may be fed on the 1st day or in 3 portions on each of the first 3 days of a 10 day assay period. The rats are to be killed on the 11th day.
3. The supplements may be fed on the 1st day or in equal portions on each of the first 3 or 5 days of a 7 day assay period. The rats are to be killed on the 8th day.
4. Admixture with the quantity of basal ration that will be consumed in 7 or 8 days. The unsupplemented basal ration is to be fed during the remainder of a 10 day assay period and the rats killed on the 11th day.
5. Admixture with the quantity of basal ration that will be consumed in 4 or 5 days. The unsupplemented basal ration is to be fed during the remainder of a 7 day assay period and the rats killed on the 8th day.

Evaporated and Dried Milks:

Evaporated or dried milk may be incorporated with the basal ration (paragraphs 4 and 5) or diluted to original volume (paragraphs 1–3).